

**CLAIMS**

1. A method for controlling a light emitting device during and without  
disrupting data transmission, comprising:  
modulating a light emitting device with a noise-level test signal  
embedded in a data signal to produce a modulated signal output;  
acquiring the modulated signal from the light emitting device;  
extracting the noise-level test signal from the acquired signal;  
digitally processing the extracted noise-level test signal to calculate  
power control adjustments; and  
controlling output power of the light emitting device by applying the  
calculated power control adjustments to the light emitting device.
2. A method for controlling a laser during and without disrupting data  
transmission, comprising:  
generating a noise-level test signal having a predetermined  
characteristic;  
generating a data signal having a predetermined characteristic;  
*modulating a laser with the generated noise-level test signal and the data*  
signal to produce a modulated output signal;  
acquiring the modulated output signal;  
extracting a noise-level test signal from the acquired modulated output  
signal;  
determining an average value of the extracted noise-level test signal;  
determining a characteristic of the extracted noise-level test signal;  
calculating a bias current adjustment from the characteristic of the  
extracted noise-level test signal;  
calculating a modulation current adjustment from a ratio of the  
characteristic of the generated noise-level test signal to the characteristic slope  
of the extracted noise-level test signal;  
controlling a laser bias current by applying the calculated bias current  
adjustment to a laser driver; and  
controlling a laser modulation current by applying the calculated  
modulation current adjustment to the laser driver.

3. The method of claim 2 wherein the noise-level test signal is a sinusoidal  
2 signal.
4. The method of claim 2 wherein the noise-level test signal is a saw tooth  
2 signal.
5. The method of claim 2 where the noise-level test signal is a composite  
4 signal.
6. The method of claim 2 wherein the noise-level test signal is extracted by  
2 applying a digital signal processing lock-in detector algorithm and filtering to the  
acquired modulated output signal.  
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7. The method of claim 2 wherein the noise-level test signal is extracted by  
2 a applying a digital signal processing quadrature detector algorithm and filtering  
to the acquired modulated output signal.  
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8. The method of claim 2 wherein the noise-level test signal is extracted by  
2 a applying a digital signal processing regression detector algorithm and filtering  
to the acquired modulated output signal.  
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9. An apparatus for controlling a laser during and without disrupting data  
2 transmission, comprising:  
4 a laser driver for modulating the laser with a noise-level test signal  
embedded in a data signal to produce a modulated output signal from the laser;  
6 a monitor photodiode for acquiring the modulated signal from the laser;  
a digital signal processor for extracting a noise-level test signal from the  
acquired signal and digitally processing the extracted noise-level test signal to  
8 calculate power control adjustments; and  
a servo for controlling output power of the laser by applying the  
10 calculated power control adjustments to the laser driver.

10. A method for controlling output power of a laser during and without  
2 disrupting data transmission, comprising:  
embedding an original test signal in system noise;  
4 modulating the original test signal and system noise;  
mathematically extracting the embedded test signal from the modulated  
6 system noise;  
applying digital signal processing algorithms to the extracted test signal  
8 to calculate power control adjustments from differences between the original  
test signal and the extracted test signal; and  
10 applying the calculated power control adjustments to the laser.
11. An apparatus for controlling a laser during and without disrupting data  
2 transmission, comprising:  
a laser driver for modulating the laser with data to produce a modulated  
4 output signal;  
a high frequency monitor photodiode for acquiring the modulated output  
6 signal from the laser and following amplitudes of the modulated output signal;  
a digital signal processor for performing peak and valley detection of the  
8 followed amplitudes of the acquired output signal, and for calculating power  
control adjustments from the peak and valley detection; and  
10 a servo for controlling output power of the laser by applying the  
calculated power control adjustments to the laser driver.
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12. An method for controlling a laser system during and without disrupting  
2 data transmission, comprising:  
embedding a noise-level test signal in system noise of a data signal in a  
4 first laser transceiver;  
transmitting a data signal containing the noise-level test signal embedded  
6 in system noise from the first laser transceiver to a second laser transceiver  
using optical path;  
8 receiving the transmitted signal at the second laser transceiver.

detecting, recovering and digitally processing the noise-level test signal  
10 at the second transceiver to determine characteristic information about the first  
laser transceiver and the optical path;  
12 sending the characteristic information from the second laser transceiver  
to the first laser transceiver;  
14 receiving the characteristic information at the first transceiver; and  
adjusting the output characteristics of the first laser transceiver according  
16 to the received characteristic information.

2 13. A method for extracting a noise-level test signal from a modulated data  
signal during and without disrupting data transmission, comprising:  
4 modulating a data signal containing an original noise-level test signal to  
produce a modulated output signal;  
6 acquiring the modulated output signal;  
multiplying the acquired modulated output signal by a copy of the original  
8 noise-level test signal to shift the frequency of an acquired noise-level test  
signal *within the acquired modulated signal*; and  
10 filtering the frequency shifted noise-level test signal from the acquired  
modulated signal.

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14. A method for extracting a noise-level test signal from a modulated data  
2 signal during and without disrupting data transmission, comprising:  
modulating a data signal containing an original sinusoidal noise-level test  
4 signal to produce a modulated output signal;  
acquiring the modulated output signal;  
6 splitting the acquired modulated signal into a first half and a second half;  
multiplying the first half of the acquired modulated output signal by a  
8 sinusoidal copy of the original sinusoidal noise-level test signal to shift the  
frequency of an acquired noise-level test signal within the acquired modulated  
10 signal;  
filtering the frequency shifted sinusoidal noise-level test signal from the  
12 acquired modulated signal;

- squaring the filtered sinusoidal noise-level test signal;
- 14 multiplying the second half of the acquired modulated output signal by a  
cosinusoidal copy of the original sinusoidal noise-level test signal to produce a
- 16 cosinusoidal noise-level test signal and shift the frequency of the acquired  
cosinusoidal noise-level test signal within the acquired modulated signal;
- 18 filtering the frequency shifted cosinusoidal noise-level test signal from the  
acquired modulated signal;
- 20 squaring the filtered cosinusoidal noise-level test signal; and
- adding the squared sinusoidal and cosinusoidal acquired test signals to
- 22 produce an amplitude of the acquired noise-level test signal.

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